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# Weights and fat scores of migrating and wintering Blackcaps *Sylvia atricapilla* in the Sudan

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Visible fat score has often been discussed as an index of flight range in migrating birds (e.g. Biebach *et al.* 1989, Greenwood 1992). Fat score reflects total body fat content closely within a species, but interspecific comparison may be limited by small differences of body proportion and fat distribution pattern. Fat scores are generally linked to body weight, but weight may be affected significantly by components other than fat. Thus protein may provide an additional energy source on migration (e.g. Lindstrom & Piersma 1993), influencing both weight and flight range. Water is a third component of importance, especially for birds facing a long sea or desert crossing (Moreau & Dolp 1970): changes in water content can markedly affect the weight of a migrant irrespective of its fat status.

This paper presents a comparison of the weights and fat scores of Blackcaps *Sylvia atricapilla* from two sites in Sudan, one used on autumn passage and the other as a wintering area. A striking weight difference between the two sites was due to body components other than fat.

## Study sites and methods

Blackcaps were caught and ringed in northeast Sudan on the Red Sea Coast (approx. 19° N, 37° E) during September-November between 1980 and 1982, and in south Sudan in the Imatong Mts (4° N, 33° E) during December and January between 1978 and 1981.

### *The Red Sea Coast*

The Red Sea Hills offer a fairly dry rocky habitat on the southern edge of the desert belt, with open bush vegetation. The area is arid in autumn with little water available, for the annual rains fall here between November and January. The main food sources for migrating passerines are probably associated with acacias along the wadis. On the coastal plains conditions are still hotter, with daily temperatures often well above 40°C, and bush and ground cover sparse and leafless. The few mangrove patches provide a temporary refuge for migrants grounded along the shore.

Blackcaps occur on the Red Sea coast almost entirely as passage migrants. Autumn migration begins in mid September, peaks in the second half of

October, then tails off until late November. Birds arrive after crossing 1000–2000 km of desert and open sea. Some stay for a few days to use the limited feeding possibilities.

*The Imatong Mountains*

These highlands near the Uganda border rise to about 3000 m. They offer ideal feeding and wintering conditions for Blackcaps, especially in the open secondary growth of degraded forest above 1600 m. The first birds arrive in late November, and the main wintering numbers are present from mid December until March.

Blackcaps were caught at both sites with mist-nets and immediately processed. Wing-length (maximum flattened chord) was recorded by the author according to Spencer (1984, method (iii)). Birds were weighed to the nearest 0.5 g using a 'Pesola' spring balance of range 0–50 g. Fat was scored according to Pearson & Backhurst (1976), using a 1–4 scale based on the appearance of the tracheal pit, as follows:

1 Fat absent or in traces only (pit 10% covered)
2 Pit partly covered with fat
3 Pit fully covered and level with pectoral muscles
4 Pit covered, bulging and overflowing above the pectoral muscles.

In practice, birds with a fat score of 4 were not encountered.

Plumage colour and wing-lengths indicated that Blackcaps from both sites were nominate-race birds from the eastern part of the breeding range, probably from Scandinavia and European Russia.

## Results and discussion

Table 1 shows weights for three different periods on the Red Sea coast, and for two different periods in the Imatongs. In each case details are presented for the whole sample and separately for birds with fat scores of 1, 2 and 3 respectively.

On the Red Sea coast, weights ranged from 13–21 g, but about half of all birds still had moderate fat reserves (Fat 2–3). Mean weight decreased during the passage season, from almost 17 g in early October to below 16 g in November. There was a corresponding decrease in the percentage of birds scoring Fat 3 (from 43% in early Oct to 9% in Nov). In the Imatongs, weights were much higher than at the Red Sea, ranging from 17– 23 g, with a mean of 19.9 g in December and 19.3 g in January. Yet visible fat scores were if anything lower than at the Red Sea, with few birds scoring 3. Table 2 compares weights of Red Sea and Imatongs birds with the same fat score. A difference of about 4 g emerges for all three categories.

Red Sea weights were very low. The overall mean of 16.2 g was far below that of lean birds on breeding grounds in southern Finland (19.2 g; Berthold

**Table 1.** Weights of Blackcaps caught during various autumn and winter periods at the Red Sea Coast and the Imatong Mts, Sudan

| | N | Weights (g) | | |
|---|---|---|---|---|
| | | Mean | S.d. | Range |
| *Red Sea, Sep/first half Oct* | | | | |
| Whole sample | 23 | 16.9 | 1.66 | 13.0–19.5 |
| Fat 1 | 5 | 15.3 | 1.60 | 13.0–17.5 |
| Fat 2 | 8 | 16.7 | 0.97 | 15.5–18.5 |
| Fat 3 | 10 | 17.7 | 1.29 | 16.0–19.5 |
| *Red Sea, second half Oct* | | | | |
| Whole sample | 125 | 16.2 | 1.41 | 13.5–21.0 |
| Fat 1 | 64 | 15.6 | 0.92 | 13.5–18.0 |
| Fat 2 | 41 | 16.2 | 1.12 | 13.5–18.0 |
| Fat 3 | 20 | 18.1 | 1.36 | 16.0–21.0 |
| *Red Sea, Nov* | | | | |
| Whole sample | 32 | 15.8 | 1.51 | 13.0–19.0 |
| Fat 1 | 20 | 14.9 | 0.91 | 13.0–16.0 |
| Fat 2 | 9 | 17.7 | 0.75 | 16.0–18.0 |
| Fat 3 | 3 | 17.2 | 1.02 | 16.5–19.0 |
| *Imatongs, Dec* | | | | |
| Whole sample | 154 | 19.9 | 1.26 | 17.0–22.5 |
| Fat 1 | 78 | 19.2 | 1.05 | 17.0–21.5 |
| Fat 2 | 72 | 20.6 | 1.00 | 18.5–22.5 |
| Fat 3 | 4 | 21.6 | 0.89 | 20.5–22.5 |
| *Imatongs, Jan* | | | | |
| Whole sample | 98 | 19.3 | 1.14 | 17.0–23.0 |
| Fat 1 | 71 | 19.0 | 1.01 | 17.0–21.5 |
| Fat 2 | 26 | 20.1 | 0.89 | 18.5–22.0 |
| Fat 3 | 1 | 23.0 | — | 23.0 |

**Table 2.** Weights of Blackcaps with particular fat scores: Red Sea and Imatong birds compared

| | N | Weights (g) | |
|---|---|---|---|
| | | Mean | Range |
| *Fat 1* | | | |
| Red Sea | 89 | 15.38 | 13.0–18.0 |
| Imatongs | 149 | 19.11 | 17.0–21.5 |
| *Fat 2* | | | |
| Red Sea | 58 | 16.40 | 13.5–18.0 |
| Imatongs | 98 | 20.44 | 18.5–22.5 |
| *Fat 3* | | | |
| Red Sea | 33 | 17.91 | 16.0–21.0 |
| Imatongs | 5 | 21.90 | 20.5–23.0 |

*et al.* 1990). Yet moderately fat birds (Fat 2–3) were well represented among passage arrivals, especially early in the migration period. Birds trapped on the wintering grounds 2000 km further south some 4-6 weeks later had regained good body weights, similar to those of the Finnish breeding birds, but the majority, especially in January, were lean (Fat 1).

Visible fat score should reflect the stored fat level. The difference in weight at the two study areas between birds with the same fat score must indicate a major difference in body components other than fat. Three factors are likely to have been involved. The Red Sea birds probably carried less protein (and associated water) than those in the Imatongs. After an arduous desert crossing they may well also have been dehydrated, in the sense of having a low water index (water to non-fat body weight ratio). Finally, the stomachs of these migratory transients may have held less food.

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